4.8 Energy

The Board's environmental regulations at 49 CFR 1105.7(e)(4) address four factors to be considered relating to energy: effects on transportation of energy resources; effects on recyclable commodities; increases or decreases in overall energy efficiency; and effects on freight diversions from rail to motor carriage. Because the Proposed Action would have a negligible effect on freight diversions to or from rail, the Proposed Action will not trigger that criterion. However, because the Proposed Action would result in a longer route for the Applicant's freight passage around Chicago, as well as reduced congestion, idling and travel distance for interchanges with other railroads, this section of the document provides an analysis of the Proposed Action's potential effects on the Board's third criterion, energy efficiency.

The energy analysis focuses on overall energy efficiency and total fuel use changes that would be caused by the Proposed Action. This section also includes a discussion of the effect of the Proposed Action on transportation of energy resources and on recyclable commodities.

The following is a summary of the findings presented in this section:

- SEA calculated energy use for all direct uses of energy resulting from the Proposed Action. Although train operations would be more efficient, the distance traveled would be longer using the EJ&E rail line, resulting in a net increase in annual energy use, based on CN's revised fuel use estimates, of 631,255 gallons of diesel fuel for train operations (639,442 gallons of diesel including trucks at grade crossings). [Section 4.8.3.1]
- Fuel use caused by cars and trucks idling at a highway/rail at-grade crossing would increase by approximately 84,242 gallons of gasoline and 8,187 gallons of diesel fuel per year in 2015. This is a net increase, taking into account reduced wait times on the CN subdivisions. [Section 4.8.5]
- SEA does not expect truck-to-rail diversions as a result of the Proposed Action and thus no energy impacts from such diversions. [Section 4.8.4]

4.8.1 Transportation of Energy Resources

SEA evaluated the energy-producing commodities that would be transported on rail lines affected by the Proposed Action. The commodities include coal, crude oil, high-volatile fuels, kerosene, fuel oils, heavy fuel oils, butane, propane, isobutene, coal gas, Pintsch gas, liquefied petroleum gas, and solid fuels. To the extent that energy-producing commodities are currently transported on rail lines affected by the Proposed Action, these commodities will continue to be transported in the future, with no effect on the amounts transported being caused by the Proposed Action.

4.8.2 Transportation of Recyclable Commodities

SEA evaluated the recyclable commodities that may be transported on rail lines affected by the Proposed Action. To the extent that recyclable commodities are currently transported on rail lines affected by the Proposed Action, these commodities will continue to be transported in the future, with no effect on the amounts transported being caused by the Proposed Action.

4.8.3 Energy Use and Energy Efficiency

SEA calculated energy use for all direct uses of energy that would result from the Proposed Action. To determine energy use in common terms, all fuel types (such as diesel and gasoline) were converted from gallons to millions of British thermal units (MMBtu).

For the net 2015 energy use analysis, two sets of estimates were prepared by the Applicant to reflect data originally supplied in the Operating Plan and data that considered fuel-savings benefits as a result of improved connections and less locomotive idling time. See Section 4.9.1.1, Operational Air Emissions Methodology for a detailed discussion of the fuel use data.

4.8.3.1 Energy Use Caused by Proposed Changes in Rail Line Operations

Methodology

The net change in energy use caused by proposed changes in rail line operations was developed based on a comparison of current and projected annual fuel use changes on the CN and EJ&E rail line segments. Additionally, SEA also considered fuel use changes for other carriers operating on the CN Rail Line and EJ&E Rail Line segments. Finally, SEA considered the change in fuel use resulting from reduced idling time by CN trains (Applicants 2008j). For these fuel use changes, which were provided in imperial gallons per day, the data were converted to U.S. gallons, and then multiplied by 365 to give values in units of U.S. gallons per year. This value was then multiplied by a conversion factor (139,000 Btu/gal) and divided by 1 million to yield MMBtu units.1

Comparison of No-Action and Proposed Action Energy Use

Table 4.8-1, Table 4.8-2, Table 4.8-3, and Table 4.8-4, as follows, summarize the estimates for energy use related to No Action and Proposed Action operations of CN trains, operations of other carriers on CN and EJ&E lines, and locomotive idling reductions resulting from the Proposed Action. Table 4.8-1 provides data in CN's original fuel use estimates, while Tables Table 4.8-2, Table 4.8-3, and Table 4.8-4 provide data from CN's revised fuel use estimates. Energy use increases in the Proposed Action, compared with the No Action, would be caused by longer routes taken in the Proposed Action scenario. Energy use decreases in the Proposed Action, as shown in Tables 4.8-3 and 4.8-4, would be caused by improved efficiencies in the overall system, thus leading to less idling fuel use by CN trains and less idling and moving fuel use by other carriers on tracks affected by the Proposed Action.

Table 4.8-1. Energy Use Changes Caused by Operations of Moving CN Trains – Original Estimates

	Moving CN Trains on EJ&E (U.S. gal/day)	Moving CN Trains on CN and Other (U.S. gal/day)	Moving CN Trains on EJ&E (U.S. gal/yr)	Moving CN Trains on CN and Other (US gal/yr)	Total Energy Use (U.S. gal/yr)	Annual Energy Use (MMBtu/yr)a
No Action	439	13,591	160,377	4,960,826	5,121,203	711,847
Proposed Action	18,772	2,046	6,851,706	746,957	7,598,663	1,056,214
Net change	18,332	(11,545)	6,691,329	(4,213,869)	2,477,460	344,367

Notes: Columns may not sum exactly due to rounding.
[a] Energy content of diesel fuel is assumed to be 139,000 Btu/gal per the Energy Information Administration, 2008, "Converting Energy Units 101," *Energy Information Administration*, retrieved on June 25, 2008, http://www.eia.doe.gov/basics/conversion_basics.html.

[1] Diesel energy content is assumed to equal to 139,000 Btu/gal (Energy Information Administration 2008).

Table 4.8-2. Energy Use Changes Caused by Operations of Moving CN Trains – Revised Estimates						
	Moving CN Trains on EJ&E (U.S. gal/day)	Moving CN Trains on CN and Other (U.S. gal/day)	Moving CN Trains on EJ&E (U.S. gal/yr)	Moving CN Trains on CN and Other (US gal/yr)	Total Energy Use (U.S. gal/yr)	Annual Energy Use (MMBtu/yr)[a]
No Action	440	13,592	160,442	4,960,977	5,121,418	711,877
Proposed Action	16,974	2,277	6,195,413	831,140	7,026,553	976,691
Net change	16,534	(11,315)	6,034,971	(4,129,837)	1,905,134	264,814

Notes: Columns may not sum exactly due to rounding.

[a] Energy content of diesel fuel is assumed to be 139,000 Btu/gal per the Energy Information Administration, 2008, "Converting Energy Units 101," *Energy Information Administration*, retrieved on June 25, 2008, http://www.eia.doe.gov/basics/conversion_basics.html.

Table 4.8-3. Energy Use Changes Caused by Operations of Moving and Idling Other Carriers on All Lines – Revised Estimates						
	Moving Other Trains (U.S. gal/day)	Idling Other Trains (U.S. gal/day)	Moving Other Trains (U.S. gal/yr)	Idling Other Trains (U.S. gal/yr)	Total Energy Use (U.S. gal/yr)	Annual Energy Use (MMBtu/yr)[a]
No Action	3,366	321	1,228,737	117,043	1,345,781	187,063
Proposed Action	1,178	12	430,036	4,384	434,420	60,384
Net change	(2,188)	(309)	(798,701)	(112,660)	(911,361)	(126,679)

Notes: Columns may not sum exactly due to rounding.

[a] Energy content of diesel fuel is assumed to be 139,000 Btu/gal per the Energy Information Administration, 2008, "Converting Energy Units 101," *Energy Information Administration*, retrieved on June 25, 2008, http://www.eia.doe.gov/basics/conversion_basics.html.

Table 4.8-4. Energy Use Changes Caused by Idling Reductions for CN Trains – Revised Estimates						
	Idling CN Trains on EJ&E (U.S. gal/day)	Idling CN Trains on CN and Other (U.S. gal/day)	Idling CN Trains on EJ&E (U.S. gal/yr)	Idling CN Trains on CN and Other (U.S. gal/yr)	Total Energy Use (U.S. gal/yr)	Annual Energy Use (MMBtu/yr)[a]
No Action	0	1,582	0	577,327	577,327	80,248
Proposed Action	299	289	109,153	105,646	214,799	29,857
Net change	299	(1,292)	109,153	(471,681)	(362,528)	(50,391)

Notes: Columns may not sum exactly due to rounding.

[a] Energy content of diesel fuel is assumed to be 139,000 Btu/gal per the Energy Information Administration, 2008, "Converting Energy Units 101," *Energy Information Administration*, retrieved on June 25, 2008, http://www.eia.doe.gov/basics/conversion_basics.html.

4.8.3.2 Energy Efficiency of Proposed Changes in Rail Line Operations

Methodology

The Applicants provided estimates of changes in energy efficiency as a result of the Proposed Action. In spite of projected increases in direct fuel use by CN, and therefore an increase in energy use, the energy efficiency of the system, measured in gallons per gross ton mile, would be substantially improved as a result of the Proposed Action. This is the result of bigger trains under the Proposed Action as compared with the No Action Alternative. Efficiencies were calculated by dividing the fuel use by the gross ton-miles per day (gtm/d).

Comparison of No Action and Proposed Changes in Rail Line Operations Fuel Efficiency

Table 4.8-5 (Original CN data) and Table 4.8-6 (Revised CN data) summarize the changes in energy efficiency comparing No Action to the Proposed Action operations of CN trains. The EJ&E route is longer than the No Action route; therefore, the increase in ton-miles will cause an increase in energy usage. However, the efficiency of the system, measured in gallons per gtm, would improve. This is seen in the value of gallons per 1,000 gtm, which implies greater energy efficiency as the value decreases.

Table 4.8-5. Energy Efficiency Changes for Operations of CN and Other Trains – Original Estimates

	CN Trains on EJ&E (U.S. gal/d)a	CN Trains on CN and Other (U.S. gal/d)a	Other Trains (U.S. gal/d)a	All Affected Trains (U.S. gal/d)a	CN Trains on EJ&E (gtm/d)	CN Trains on CN and Other (gtm/d)	Other Trains (gtm/d)	All Affected Trains (gtm/d)	Energy Efficiency (U.S. gal/1,000 gtm)
No Action	439	13,591	no data	14,030	340,192	12,066,766	no data	12,406,958	1.13
Proposed Action	18,772	2,046	no data	20,817	19,677,755	1,681,185	no data	21,358,940	0.97

Notes: Columns may not sum exactly due to rounding.
[a] Conversion between imperial gallons and U.S. gallons is 1.201 U.S. gallons per imperial gallon.

Table 4.8-6. Energy Efficiency Changes for Operations of CN and Other Trains – Revised Estimates

	CN Trains on EJ&E (U.S. gal/d)a	CN Trains on CN and Other (U.S. gal/d)a	Other Trains (U.S. gal/d)a	All Affected Trains (U.S. gal/d)a	CN Trains on EJ&E (gtm/d)	CN Trains on CN and Other (gtm/d)	Other Trains (gtm/d)	All Affected Trains (gtm/d)	Energy Efficiency (U.S. gal/1,000 gtm)
No Action	440	13,592	3,366	17,398	340,192	12,066,766	2,642,519	15,049,477	1.16
Proposed Action	16,974	2,277	1,178	20,429	17,213,079	2,686,396	941,805	20,841,280	0.98

Notes: Columns may not sum exactly due to rounding.
[a] Conversion between imperial gallons and U.S. gallons is 1.201 U.S. gallons per imperial gallon.

4.8.3.3 Energy Use by Vehicle Idling at Highway/Rail At-Grade Crossings

Methodology

The methodology for determining fuel use caused by motor vehicles idling at crossings uses the procedure for calculating the total annual vehicle delay hours (Dan) found in Section 4.3.1, Regional and Local Highway Systems. SEA used 2007 ADTs to calculate existing traffic delays and county-specific growth factors to develop ADTs at each public at-grade crossing for the analysis year.

SEA calculated both gasoline and diesel fuel use from annual motor vehicle delays at a crossing by multiplying the total vehicle delay hours (Dan) by the percentage of gasoline and diesel vehicles in the default setting for national fleet average mix set out in the U.S. Environmental Protection Agency's (EPA) MOBILE6.2 vehicle emission modeling software (EPA 2003b). For 2015, the mix is 91.1 percent gasoline and 8.9 percent diesel engines. Total annual delay hours were multiplied by these ratios and fuel consumption rates (0.5 gallons per hour of idling) to give an annual fuel usage resulting from all vehicles idling because of delays at public at-grade intersections (Clark et al. 2005; Gaines et al. 2006). These values were then multiplied by a conversion factor (124,000 Btu/gal for gasoline, 139,000 Btu/gal for diesel) to give the values in MMBtu units.

Comparison of No Action and Proposed Changes in Rail Line Operations Energy Use

Table 4.8-7, below, summarizes the estimates for fuel use under the No Action and Proposed Action for idling traffic in the year 2015. The table also includes a summary of the calculation of No Action and Proposed Action hours of idling along intersections crossing both CN and EJ&E lines.

Table 4.8-7. 2015 Energy Use Changes Caused by Traffic Delay

Scenario	Hours of Vehicle Idling on EJ&E Lines	Hours of Vehicle Idling on CN Lines	Total Hours of Vehicle Idling on All Lines	Vehicles by Fuel Type a		Annual Fuel Usage (U.S. gal/yr)		Annual Fuel Usage (MMBtu/yr)	
				Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel
No Action	102,103	582,706	684,809	91.1%	8.9%	312,067	30,337	38,696	4,217
Proposed Action	752,843	116,823	869,666			396,307	38,526	49,142	5,355
Net change	650,740	(465,882)	184,857			84,239	8,189	10,446	1,138

Notes: Columns may not sum exactly due to rounding.

[a] Taken from MOBILE6.2 as default national fleet-mix value.

[b] Energy content of gasoline is assumed to be 124,000 Btu/gal, and energy content of diesel fuel is assumed to be 139,000 Btu/gal, per the Energy Information Administration.

Energy use caused by traffic delay would increase along the EJ&E route in the Proposed Action, while energy use would decrease along the CN route under the Proposed Action. The net fuel and energy use for the entire system in 2015 increases in the Proposed Action compared with the No Action Alternative because of the re-routing of longer CN trains to the longer EJ&E route, which has more public at-grade intersections than the current CN rail lines.

4.8.4 Change in Energy Use Caused by Truck-to-Rail Diversions

There is no expected growth in rail-related freight transport attributed to the Proposed Action, no change in transports of freight that otherwise would be carried by over-the-road trucks, and no diversions to truck that otherwise would be carried by rail. Therefore, there are no energy impacts resulting from these activities.

4.8.5 Net Change in Energy Use

SEA summed the annual net changes in fuel use, positive and negative, for the 2015 Proposed Action and No Action Alternative, as shown in Table 4.8-8 (Original CN data) and Table 4.8-9 (Revised CN data), both of which follow. See Section 4.9.1.1, Operational Air Emissions Methodology for a detailed discussion of the fuel use data, which reflects data originally supplied in the Operating Plan and data that considered fuel-savings benefits as a result of improved connections and less locomotive idling time. Ironically, the revised data showing fuel-savings benefits in the Net Change also shows a greater fuel use value in the Proposed Action. This is because the revised data considered more sources of fuel use (specifically, moving and idling fuel use of other carriers, as well as idling fuel use of CN trains) than did the original data.

The Proposed Action would result in an increase in total energy used, based on the estimated fuel use information supplied by CN for train movements and idling trains and the fuel use data calculated by SEA for motor vehicle idling. The net increase in energy use is estimated to be less than 10 percent of the total energy used under the No Action alternative.

Table 4.8-8. Net 2015 Energy Use – Original Estimates

Category	Source	No Action Energy Use (MMBtu/yr)	Proposed Action Energy Use (MMBtu/yr)	Net Change in Energy Use (MMBtu/yr)	Net Change in Fuel Use (gallons)
Operations	Moving CN trains (diesel)	711,847	1,056,214	344,367	2,477,460
	Moving and idling Other trains (diesel)	no data	no data	No data	No data
	Idling CN trains (diesel)	no data	no data	No data	No data
Intersection delay	Gasoline vehicles	38,696	49,142	10,446	84,242
	Diesel vehicles	4,217	5,355	1,138	8,187
Total		**754,760**	**1,110,711**	**355,951**	**2,569,889** [Diesel: 2,485,647] [Gasoline: 84,242]

Notes: Columns may not sum exactly due to rounding.

Table 4.8-9. Net 2015 Energy Use – Revised Estimates					
Category	Source	No Action Energy Use (MMBtu/yr)	Proposed Action Energy Use (MMBtu/yr)	Net Change in Energy Use (MMBtu/yr)	Net Change in Fuel Use (gallons)
Operations	Moving CN trains (diesel)	711,877	976,691	264,814	1,905,137
	Moving and idling Other trains (diesel)	187,063	60,384	(126,679)	(911,360)
	Idling CN trains (diesel)	80,248	29,857	(50,391)	(362,525)
Intersection delay	Gasoline vehicles	38,696	49,142	10,446	84,242
	Diesel vehicles	4,217	5,355	1,138	8,187
Total		**1,022,101**	**1,121,429**	**99,328**	**723,684** [Diesel: 639,442] [Gasoline: 84,242]

Notes: Columns may not sum exactly due to rounding.

4.8.6 Conclusions

SEA evaluated redistribution of train traffic reflected in CN's operating Plan and the resulting fuel use and fuel efficiency based on information provided by Applicant. SEA also evaluated potential fuel use arising from increased vehicle delay at at-grade crossings along the EJ&E. SEA determined that a moderate increase in fuel use would potentially result from the Proposed Action.

SEA also evaluated fuel savings from reduced train congestion and idling due to the rail traffic redistribution and fuel savings that other railroads would potentially experience due to changes in train interchange locations. The fuel savings would substantially offset the fuel use increase by CN but not entirely, therefore, there would potentially be a fairly small increase in fuel use overall.

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